REMARKS

Claims 1 through 15 remain in the application.

35 U.S.C. § 103

Claims 1 through 15 were rejected under 35 U.S.C. § 103 as being unpatentable over "Handbook of Simulation" edited by Jerry Banks in view of "Simulation Modeling with Event Graphs" by Lee Schruben. Applicants respectfully traverse this rejection.

As to patentability, 35 U.S.C. § 103 provides that a patent may not be obtained:

> If the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Id.

The United States Supreme Court interpreted the standard for 35 U.S.C. § 103 in Graham v. John Deere, 383 U.S. 1, 148 U.S.P.Q. 459 (1966). In Graham, the Court stated that under 35 U.S.C. § 103:

> The scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or non-obviousness of the subject matter is determined. 148 U.S.P.Q. at 467.

The "Handbook of Simulation", edited by Jerry Banks, discloses principles, methodology, advances, applications, and practice. An entity represents an object that requires explicit definition. An entity can be dynamic in that it "moves" through the system, or it can be static in that it serves other entities. An entity may have attributes that pertain to that entity alone. Thus attributes should be considered local values. A resource is an entity that provides service to dynamic entities. The resource can serve one or more than one dynamic entity at the

same time (i.e., operate as a parallel server). A dynamic entity can request one or more units of a resource. Verification concerns the operational model. Is it performing properly? Validation is the determination that the conceptual model is an accurate representation of the real system. If the client has been involved throughout the study period, and the simulation analyst has followed all the steps rigorously, the likelihood of a successful implementation is increased.

The "Simulation Modeling with Event Graphs" by Lee Schruben discloses that an event graph can be used to develop alternative event-oriented representations of a system. Several candidate model structures can be considered for possible implementation as discrete-event simulations using an event-scheduling approach. Applications of basic graph analysis techniques are illustrated in the context of two examples. Event graph analysis can aid in identifying state variables, in determining what events must be initially scheduled, in anticipating possible logic errors due to simultaneous events, and in eliminating unnecessary event routines prior to coding a simulation.

In contradistinction, independent claim 1 claims the present invention as a method of logical modeling operator interaction with a programmable logic controller logical verification system. The method includes the steps of constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations. The method also includes the steps of modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart. The method includes the steps of testing the control model by a PLC logical verification system on the computer as to whether PLC logic for the workcell is correct. The method further includes the steps of loading the PLC logic in the PLC controlling the workcell if the PLC logic for the workcell is correct and using the PLC logic by the PLC to operate the workcell.

Independent claims 9 and 15 are similar to claim 1 and include other features of the present invention such as the operator being a human operator.

The United States Court of Appeals for the Federal Circuit (CAFC) has stated in determining the propriety of a rejection under 35 U.S.C. § 103, it is well settled that the obviousness of an invention cannot be established by combining the teachings of the prior art absent some teaching, suggestion or incentive supporting the combination. See In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 227 U.S.P.Q. 657 (Fed. Cir. 1985); ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 221 U.S.P.Q. 929 (Fed. Cir. 1984). The law followed by our court of review and the Board of Patent Appeals and Interferences is that "[a] prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art." In re Rinehart, 531 F.2d 1048, 1051, 189 U.S.P.Q. 143, 147 (C.C.P.A. 1976). See also In re Lalu, 747 F.2d 703, 705, 223 U.S.P.Q. 1257, 1258 (Fed. Cir. 1984) ("In determining whether a case of prima facie obviousness exists, it is necessary to ascertain whether the prior art teachings would appear to be sufficient to one of ordinary skill in the art to suggest making the claimed substitution or other modification.")

As to the differences between the prior art and the claims at issue, Banks merely discloses a handbook of simulation in which an entity can be dynamic in that it "moves" through the system, verification of an operational model, and validation of the conceptual model being an accurate representation of the real system. Banks lacks constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations and modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in

the workcell based on predefined conditions described in the flowchart. Banks also lacks testing the control model by a PLC logical verification system on the computer as to whether PLC logic for the workcell is correct and loading the PLC logic in the PLC controlling the workcell if the PLC logic for the workcell is correct. In Banks, there is no logical modeling of operator interaction with a programmable logic controller logical verification system and there are no asynchronous operations of the operator. Also in Banks, there is no modeling of an operator as an input to a programmable logic controller (PLC). Further, Banks is not used to debug PLC logic.

Schruben merely discloses that an event graph can be used to develop alternative event-oriented representations of a system in which several candidate model structures can be considered for possible implementation as discrete-event simulations using an event-scheduling approach. Schruben lacks constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations. In Schruben, there are discrete event simulations, which are time based, and cannot account for asynchronous operations. For example, the (random) time required to repair a jammed machine is modeled as a discrete or time based event because it is denoted by "t" and, therefore, cannot be an asynchronous operation. The passages from Schruben cited by the Examiner do not constitute constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations. In Schruben, an operator may be responsible for loading and unloading parts that are processed by a machine as well as freeing a jammed machine, but this operator interaction is not modeled by a flowchart. Further, there is no modeling of an operator as an input to a programmable logic controller (PLC). As such, there is no suggestion or motivation in the art to combine Banks and Schruben together.

As to the level of ordinary skill in the pertinent art, in Banks, an entity can be dynamic in that it "moves" through the system. In Schruben, discrete event simulations are used for time dependent events and do not allow for asynchronous operations, which are not time dependent. Further, neither reference allows for modeling of an operator as an input to a programmable logic controller (PLC). As such, there is absolutely no teaching of a level of skill in the programmable logic controller art that a method of logical modeling operator interaction with a programmable logic controller logical verification system includes the steps of constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations, modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart, and testing the control model by a PLC logical verification system on the computer as to whether PLC logic for the workcell is correct. The Examiner may not, because he doubts that the invention is patentable, resort to speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis. See In re Warner, 379 F. 2d 1011, 154 U.S.P.Q. 173 (CCPA 1967).

Even if the reference could be combined, they do not teach a level of skill in the art of programmable logic controller of logical modeling operator interaction with a programmable logic controller logical verification system includes the steps of modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart. Applicants are not attacking the references individually, but are clearly pointing out that each reference is deficient and, if combined (although Applicants maintain that they are not combinable), the combination is deficient. The present invention sets forth a unique and non-

obvious combination of a method for logical modeling of operator interaction with a programmable logic controller logical verification system that allows a user to verify that the PLC code being planned will work as intended, prior to physically building the tools/manufacturing line and locating equipment. Unlike the prior art, the focus of the present invention is on the logical representation of the operator and not the visual or spatial representations of the operator. Contrary to the Examiner, this is reflected in the claim language because it recites the step of modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart.

In addition, the Examiner has adduced no factual basis to support his/her position that it would have been obvious to one of ordinary skill in the art to include the operator and operator's interaction with the PLC-controlled machinery in the PLC logical verification system taught by Banks and that the modification could comprise a "simulated operator" pushing a START or RESTART button on a PLC-controlled machine after "freeing a jammed machine". Thus, the Examiner's stated conclusion of obviousness is based on speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis.

The references, if combinable, fail to teach or suggest the combination of a method of logical modeling operator interaction with a programmable logic controller logical verification system including the steps of constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations, modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart, testing the control model by a PLC logical verification system on the computer as to whether PLC logic for the workcell is correct,

loading the PLC logic in the PLC controlling the workcell if the PLC logic for the workcell is correct, and using the PLC logic by the PLC to operate the workcell as claimed by Applicants.

Further, the CAFC has held that "[t]he mere fact that prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification". In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). The Examiner has failed to show how the prior art suggested the desirability of modification to achieve Applicants' invention. Thus, the Examiner has failed to establish a case of prima facie obviousness. Therefore, it is respectfully submitted that claims 1 through 15 are allowable over the rejection under 35 U.S.C. § 103.

Obviousness under § 103 is a legal conclusion based on factual evidence (In re Fine, 837 F.2d 1071, 1073, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988), and the subjective opinion of the Examiner as to what is or is not obvious, without evidence in support thereof, does not suffice. Since the Examiner has not provided a sufficient factual basis, which is supportive of his/her position (see In re Warner, 379 F.2d 1011, 1017, 154 U.S.P.Q. 173, 178 (C.C.P.A. 1967), cert. denied, 389 U.S. 1057 (1968)), the rejection of claims 1 through 15 is improper. Therefore, it is respectfully submitted that claims 1 through 15 are allowable over the rejection under 35 U.S.C. § 103.

Based on the above, it is respectfully submitted that the claims are in a condition for allowance or in better form for appeal. Applicants respectfully request reconsideration of the claims and withdrawal of the final rejection. It is respectfully requested that this Amendment be entered under 37 C.F.R. 1.116.

Respectfully submitted,

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